WHAT IS CLAIMED IS:

1. An optical device comprising:

an optical path provided between an input port to which signal light modulated at a frequency f_s is supplied and an output port; and

an optical loop optically coupled to said optical path;

said optical loop comprising:

an optical amplifier for compensating for a loss in said optical loop so that laser oscillation occurs in said optical loop;

an adjuster for adjusting an optical path length of said optical loop so that said frequency f_s becomes equal to an integral multiple of the reciprocal of a recirculation period of said optical loop; and

a nonlinear optical medium for mode-locking said laser oscillation according to said signal light.

2. An optical device according to claim 1, wherein said optical loop further comprises an optical bandpass filter having a passband including the wavelength of said laser oscillation.

3. An optical device according to claim 1, further comprising an optical coupler for optically coupling said optical path and said optical loop, said optical coupler

providing a part of said optical path and a part of said optical loop.

4. An optical device according to claim 1, wherein said nonlinear optical medium comprises a third-order nonlinear optical medium; and

amplitude modulation is performed in said nonlinear optical medium by four-wave mixing using said signal light as pump light.

5. An optical device according to claim 1, wherein said nonlinear optical medium comprises a semiconductor optical amplifier.

6. An optical device according to claim 1, wherein said nonlinear optical medium comprises a single-mode fiber.

7. An optical device according to claim 1, wherein said nonlinear optical medium comprises a highly-nonlinear dispersion shifted fiber.

8. An optical device according to claim 6 or 7, wherein said nonlinear optical medium has a zero-dispersion wavelength substantially equal to the wavelength of said signal light.

9. An optical device according to claim 1, further comprising an input optical amplifier optically connected to said input port for amplifying said signal light.

10. An optical device according to claim 9, further comprising an optical bandpass filter optically connected between said input port and said input optical amplifier and having a passband including a wavelength of said signal light.

11. An optical device according to claim 1, further comprising an optical bandpass filter optically connected to said output port and having a passband including a wavelength of light obtained by said laser oscillation.

12. An optical device according to claim 1, further comprising a waveform shaper optically connected to said output port for performing waveform shaping of said signal light according to an optical clock output from said output port.

13. An optical device according to claim 12, wherein said waveform shaper comprises a nonlinear optical loop mirror.

14. A system comprising:

an optical fiber transmission line for transmitting signal light modulated at a frequency f_s; and

an optical device connected to an output end of said optical fiber transmission line;

said optical device comprising:

an optical path provided between an input port to

which said signal light is supplied and an output port; and

an optical loop optically coupled to said optical path;

said optical loop comprising:

an optical amplifier for compensating for a loss in said optical loop so that laser oscillation occurs in said optical loop;

an adjuster for adjusting the optical path length of said optical loop so that said frequency f_s becomes equal to an integral multiple of the reciprocal of a recirculation period of said optical loop; and

a nonlinear optical medium for mode-locking said laser oscillation according to said signal light.

15. A system comprising:

an optical fiber transmission line for transmitting signal light; and

at least one optical repeater arranged along said optical fiber transmission line;

each of said at least one optical repeater comprising:

an optical clock regenerator for regenerating an optical clock by mode locking of laser oscillation according to said signal light; and

a waveform shaper for performing waveform shaping of said signal light according to said optical clock regenerated by said optical clock regenerator.

16. A system according to claim 15, wherein said waveform shaper comprises a nonlinear optical loop mirror.

17. A method comprising the steps of:

(a) generating laser oscillation in an optical loop including a nonlinear optical medium;

(b) introducing signal light modulated at a frequency f_s into said optical loop;

(c) adjusting the optical path length of said optical loop so that said frequency f_s becomes equal to an integral multiple of the reciprocal of a recirculation period of said optical loop; and

(d) regenerating an optical clock by mode-locking said laser oscillation according to said signal light.

add B4